Amendments In the Claims

1. (Currently Amended) An apparatus for use ~~canceling far end cross talk and intersymbol interference~~ in a communication network, the apparatus comprising:

an input node configured to receive an input signal vector; and

a multi-dimensional equalizer coupled to the input node, wherein the multi-dimensional equalizer is configured to cancel far end cross talk and intersymbol interference, wherein the multi-dimensional equalizer is configured to process the input signal vector to provide an output signal vector.

2. (Currently Amended) The apparatus as set forth in claim 1, wherein the multi-dimensional equalizer is configured to combine ~~combines~~ the input signal vector with a vector error to determine a multidimensional steepest descent gradient, and further wherein the input signal vector is adjusted with the descent gradient to provide the output signal vector.

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3. (Previously Presented) The apparatus as set forth in claim 2, wherein the equalizer determines the vector error based on the output signal vector and an input channel signal vector.

4. (Previously Presented) The apparatus as set forth in claim 3, further comprising an echo canceler, wherein the input signal vector is based on the input channel signal vector after it is adjusted with the echo canceler.

5. (Previously Presented) The apparatus as set forth in claim 3, further comprising a near end cross talk canceler, wherein the input signal vector is based on the input channel signal vector after it is adjusted by the near end cross talk canceler.

6. (Currently Amended) A method ~~for canceling far end cross talk and intersymbol interference in a communication network, the method~~ comprising:

canceling far end cross talk and intersymbol interference in a communication network, wherein canceling far end cross talk and intersymbol interference comprises:

estimating a change in error between an input signal vector and an output signal vector;

determining a multidimensional steepest descent gradient based on the change in error;

adjusting the output signal vector using the descent gradient.

7. (Previously Presented) The method as set forth in Claim 6, wherein estimating the change in error between the input signal vector and the output signal vector includes determining the partial derivative of the error with respect to a tap matrix.

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8. (Previously Presented) The method as set forth in Claim 7, wherein estimating the change in error between the input signal vector and the output signal vector includes updating the tap matrix by a vector amount that is proportional to the partial derivative of the error.

9. (Previously Presented) The method as set forth in Claim 8, wherein estimating the change in error between the input signal vector and the output signal vector includes assuming that the tap matrix is symmetric.

10. (Previously Presented) The method as set forth in Claim 7, wherein estimating the change in error between the input signal vector and the output signal vector includes performing vector operations.

11. (Previously Presented) The method as set forth in Claim 7, wherein estimating the change in error between the input signal vector and the output signal vector includes passing the input signal vector through a series of unit delay operators.

12. (Currently Amended) A ~~method for canceling far end cross talk and intersymbol interference in a communication network, the method~~ comprising:

<u>canceling far end cross talk and intersymbol interference in a communication network, wherein canceling far end cross talk and intersymbol interference comprises;</u>

compensating an output signal vector based on a plurality of tap matrices and an error vector signal, wherein the error vector signal is based on the difference between an input signal vector and the compensated output signal vector.

13. (Previously Presented) The method as set forth in Claim 12, wherein compensating the output signal vector includes applying a delay to the input signal vector.

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14. (Previously Presented) The method as set forth in Claim 13, wherein compensating the output signal vector includes multiplying the error vector signal by the delayed input signal vector.

15. (Previously Presented) The method as set forth in Claim 14, wherein compensating the output signal vector includes generating the plurality of tap matrices based on a plurality of delayed tap matrices and the product of the error vector signal and the delayed input signal vector.

16. (Previously Presented) The method as set forth in Claim 15, wherein compensating the output signal vector includes generating the output signal vector based on the product of the delayed tap matrices and the delayed input signal.

17. (Previously Presented) The method as set forth in Claim 12, wherein compensating the output signal vector includes canceling echo from the input signal vector.

18. (Previously Presented) The method as set forth in Claim 12, wherein compensating the output signal vector includes canceling near end cross talk from the input signal vector.

19. (Currently Amended) An apparatus for ~~canceling far end cross talk and intersymbol interference~~ for use in a communication network, the apparatus comprising:

a multi-dimensional equalizer for canceling far end cross talk and intersymbol interference, wherein the equalizer is operable to generate an output signal vector based on an error vector.

20. (Previously Presented) The apparatus, as set forth in claim 19 wherein the equalizer further includes:

a vector delay operator coupled to generate a delayed input signal vector from an input signal vector.

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21. (Previously Presented) The apparatus, as set forth in claim 20 wherein the equalizer further includes:

a vector error operator for generating the error vector based on the delayed input signal vector and the difference between the output signal vector and the input signal vector.

22. (Previously Presented) The apparatus, as set forth in claim 21 wherein the equalizer further includes:

a first matrix multiplication operator coupled to generate the product of the delayed input signal vector and the error vector.

23. (Previously Presented) The apparatus, as set forth in claim 22 wherein the equalizer further includes:

a matrix summation operator coupled to receive the product from the first matrix multiplication operator, wherein the matrix summation operator is operable to add the product from the first matrix multiplication operator to output from a matrix tap unit delay operator.

24. (Previously Presented) The apparatus, as set forth in claim 23 wherein the output of the matrix tap unit delay operator includes a plurality of delayed tap matrices based on input from the matrix summation operator.

25. (Previously Presented) The apparatus, as set forth in claim 24 wherein the equalizer further includes:

a second matrix multiplication operator coupled to receive input from the matrix tap unit delay operator and the vector data unit delay operator, wherein the second matrix multiplication operator is operable to generate another output signal vector based on the plurality of delayed tap matrices and the delayed input signal vector.

26. (Currently Amended) An apparatus for canceling far end cross talk and intersymbol interference in a communication network, the apparatus comprising:

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a decision feedback equalizer operable to determine a multidimensional steepest descent gradient to adjust matrix coefficients that are proportional to estimates of

$$\frac{\partial e_n}{\partial Q_k^{i,j}}, \text{ wherein } \boxed{Q_k^{i,j} \leftarrow \left(Q_k^{i,j} - \mu \cdot \left(\frac{\partial e_n}{\partial Q_k^{i,j}}\right)\right)};$$

wherein en represents a vector distance between vectors Z_n and X_n;

wherein vector X_n represents a signal input to a multi-channel transmission network;

wherein Z_n is defined as $Z_n = \sum_{k=0}^{N} Q_k \cdot Y_{n-k}$

wherein Yn is a vector that represents the signal X_n after transmission through the multi-channel network;

wherein Q_k represents the kth matrix of the decision feedback equalizer;

wherein $Q_k^{i,j}$

wherein μ is a constant that regulates a step size of the multidimensional steepest descent gradient.

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27. (Previously Presented) The apparatus as set forth in Claim 26, wherein:

$$\frac{\partial e_n}{\partial Q_k^{i,j}} = 2 \cdot \left(Z_n^i - X_{n-p}^i\right) \cdot Y_{n-k}^j .$$

28. (Previously Presented) The apparatus as set forth in Claim 26, further comprising:

a vector data unit delay operator coupled to receive an input vector Y_n from a communication channel;

a vector error scaling operator for generating an error signal proportional to the difference between the output Z_n of the feedforward equalizer and the input X_n to the communication channel;

a first matrix multiplication operator coupled to multiply input from the vector data unit delay operator and the vector error scaling operator;

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a matrix summation operator coupled to add the output from the first matrix multiplication operator to the output from a matrix tap unit delay operator, wherein the matrix tap unit delay operator receives input from the matrix summation operator; and

a second matrix multiplication operator coupled to multiply input from the matrix tap unit delay operator and the vector data unit delay operator, thereby generating an output vector Z_{n+1}.

29. (Previously Presented) The apparatus, as set forth in Claim 28, wherein:

the vector data unit delay operator passes a data vector Y_n through a series of unit delay operators to generate successive tap input data Y_n, Y_{n-1}, Y_{n-2}.

30. (Previously Presented) The apparatus, as set forth in Claim 29, wherein:

the first matrix multiplication operator receives the 1xN matrix Y_{n-k} from the unit delay operator and multiplies it with the Nx1 matrix of scaled vector error data $(Z_n - X_n)$ from the vector error scaling operator.

31. (Previously Presented) The apparatus, as set forth in Claim 29, wherein:

the matrix summation operator receives a NxN adjustment matrix from the first matrix multiplication operator, adds the adjustment matrix to a Q_{n-k} matrix from the matrix tap unit delay operator, and outputs a corrected matrix Q_{n-k+1}.

32. (Previously Presented) The apparatus, as set forth in Claim 31, wherein the matrix tap unit delay operator receives the corrected matrix Q_{n-k+1} from the matrix summation operator, and introduces a one cycle delay to generate the Q_{n-k} matrix.

33. (Currently Amended) A device ~~for canceling far end cross talk and intersymbol interference in a communication network,~~ comprising:

<u>means for canceling far end cross talk and intersymbol interference in a communication network, wherein the means for canceling far end cross talk and intersymbol interference comprises;</u>

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means for compensating an output signal vector based on a plurality of tap matrices and an error vector signal, wherein the error vector signal is based on the difference between an input signal vector and the compensated output signal vector.

34. (Previously Presented) The device as set forth in Claim 33, wherein the means for compensating the output signal vector includes means for applying a delay to the input signal vector.

35. (Previously Presented) The device as set forth in Claim 34, wherein the means for compensating the output signal vector includes means for generating a product of the error vector signal and the delayed input signal vector.

36. (Previously Presented) The device as set forth in Claim 35, wherein the means for compensating the output signal vector includes means for generating the plurality of tap matrices based on a plurality of delayed tap matrices and the product of the error vector signal and the delayed input signal vector.

37. (Previously Presented) The device as set forth in Claim 36, wherein the means for compensating the output signal vector includes means for generating the output signal vector based on the product of the delayed tap matrices and the delayed input signal.

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38. (Previously Presented) The device as set forth in Claim 33, wherein compensating the output signal vector includes canceling echo from the input signal vector.

39. (Previously Presented) The device as set forth in Claim 33, wherein compensating the output signal vector includes canceling near end cross talk from the input signal vector.